

## The Effect of Hand Massage on Arteriovenous Fistula Puncture Pain

(Running Head: Effect of Hand Massage on Pain)

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### Abstract

**Background:** Patients undergoing haemodialysis experience anxiety and pain due to the insertion of haemodialysis needles, estimated totally 320 times per year. Hand massage is the most frequently preferred complementary therapy by nurses and is often used to reduce pain. This randomized controlled study was performed in patients undergoing hemodialysis treatment.

**Method:** Research was carried out in Turkey at a hemodialysis center in patients undergoing hemodialysis between 01 July - 30 September 2022. The study was completed with 50 patients, 25 patients in the intervention group and 25 patients in control group, all of whom accepted to participate in the study and met the criteria of inclusion into the study. The data of the study were collected by using Patient Information Form and Visual Analogue Scale (VAS). The forms were filled by conducting face-to-face interviews with the patients. The researcher then applied hand massage to all the patients in the intervention group at the ten minutes before the arteriovenous fistula needles have been inserted without starting dialysis session. Totally three sessions were carried out as three times a week in accordance with protocol of hand massage application. Each session lasted for 5 minutes. At the end of the application, The AVF needle was inserted to connect the patients with hemodialysis. VAS score was applied to the patients.

**Results:** The use of hand massage significantly reduced the scores of AVF puncture-related pain, which was  $6.18 \pm 1.92$  in the first session, to  $2.96 \pm 1.12$  in the second session ( $p=0.013$ ). However, mean scores of AVF puncture pain had no significant difference in the first and second follow-ups of haemodialysis in the patients of the control group ( $p=0.842$ )

**Conclusion:** The results of the present study showed that hand massage was effective in relieving pain of AVF puncture in patients undergoing haemodialysis.

**Keywords:** Hand Massage, pain, hemodialysis, nursing.

### Introduction

Chronic kidney failure (CKD) is an alarming public health problem in Turkey and all over the world. According to a census in the year 2019 about renal failure in Turkey, the total number of patients with end-stage renal failure (ERSD) was 83,783. Among this, 61,341 patients underwent hemodialysis (HD) treatment; peritoneal dialysis (PD) treatment was administered to 3292 patients and renal transplantation to 19,150 patients. The prerequisite to apply HD treatment was to ensure an appropriate vascular access, according to the data of the Turkish Nephrology Association (Turkey), arteriovenous fistula (AVF) is the most commonly used (76.5%) vascular access route in HD patients [1,2].

However, the pain associated with AVF cannulation remains a major concern among patients undergoing haemodialysis. Patients undergoing haemodialysis experience anxiety and pain due to the insertion of haemodialysis needles, estimated totally 320 times per year. Patients still suffer from this pain throughout their life or until they have a successful kidney transplantation. associated vascular access pain has been evaluated to be 82% acute and 92% chronic pain in HD patients. Such pain is caused mostly by needle insertion into a fistula. Repeated AVF puncturing may cause adverse outcomes such as anxiety, fear, intense pain, discomfort, distress, and stress [3].

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Pain management is one of the most basic nursing interventions. Inadequate pain management can lead to undesirable consequences in patients, such as depression, insomnia, functional impairment, low quality of life, decreased compliance with dialysis treatment, and increased hospitalization. By controlling pain, patients may have increased satisfaction and improved quality of life. Pain management may be achieved by nonpharmacological and pharmacological methods. Pharmacological treatments are considered as risky because they may induce addiction in the patient and cause side effects and complications [4]. On the other hand, nonpharmacological methods are recommended because they are inexpensive and cause fewer side effects and complications [5, 6]. Among nonpharmacological pain management precautions, recent studies have reported that practices such as massage, distraction, skin stimulation methods, cold applications and aromatherapy may be used as effective and safe methods to alleviate pain [7-9].

Hand massage is the most frequently preferred complementary therapy by nurses and is often used to reduce pain. The effect of massage on pain is explained by Melzack's door control theory. According to this theory. When massaging is applied, A-delta and C are fine, which are used to convey pain. A-alpha and A-beta thick touch-sense fibers moving faster than their fibers, pain. it prevents impulses from reaching higher levels in small diameter fibers carrying. The mechanoreceptors, which are at the center of the touch-sense fibers mentioned in this theory, are mostly in the hands and feet [10-12].

The literature reports that these areas are more preferred to address the pain, for reasons such as the large majority of mechanoreceptors are on the hands and feet, as well as the easy and short application of hand and foot massage. There are studies that hand and foot massage reduce the pain of patients and positively affect their life-signs [13, 14]. In addition, no study performed in Turkey evaluating the effects of hand massage in HD patients on pain has been encountered. Therefore, this study is thought to contribute to the literature.

## Methods

### Study Population and Sampling

Research was carried out in Turkey at a hemodialysis center in patients undergoing hemodialysis between 01 July -30 September 2022. The study process was based on the Consolidated Standards of Reporting Trials (CONSORT) guideline. Participants were selected from volunteering patients who had undergone hemodialysis for at least 6 months.

All patients referred by physicians working at the hemodialysis center were standardized in preliminary interviews by the researchers using the checklist and evaluated for suitability. The population of the study consisted of 114 patients receiving treatment at the hemodialysis center. For the sampling, 50 patients were included. Sixty-four patients who did not meet the inclusion criteria were excluded. The study was completed with 50 patients, 25 patients in the intervention group and 25 patients in control group, all of whom accepted to

participate in the study and met the criteria of inclusion into the study. The data of the study were analysed in the minitab program using power analysis method and the power was determined as 0.91 at alpha confidence level of 0.05. Before starting the study, all patients were informed about the study and their written informed consent was obtained. During the study, the treatment protocol of both groups was maintained as recommended by the physician and no change was made in the routine treatment of the patients. The patients continued to receive their routine treatment during the application.

Inclusion criteria were being aged 18 years and over, 2) undergoing conventional haemodialysis three times a week; 3) obtaining 3 and higher VAS pain score and 4) volunteering to participate.

Exclusion criteria were refusing to participate in the study (22 patients) and the use of pain killers within three hours before haemodialysis (20 patients).

As a result of drawing lots, the patients undergoing haemodialysis therapy in the morning were assigned to the control group; whereas, those undergoing haemodialysis therapy in the afternoon were assigned to the intervention group.

### Instruments

The data of the study were collected by using Patient Information Form and Visual Analogue Scale (VAS).

Patient information form prepared by the researchers in line with literature involved "Socio-demographic characteristics" and "disease and treatment-related information [3-7].

The VAS (0-10) was used to evaluate the pain. This scale is scored between 0 and 10; 0 shows no pain and 10 implies the worst pain. The patients show their pain by marking the right point for them on the scale. Being the most common pain assessment tool in the world, this scale allows the patients to show their pain freely [15].

### Study Group

Patient information form and VAS were applied to patients in the intervention group before hand massage application (the first interview). The forms were filled by conducting face-to-face interviews with the patients. The researcher then applied hand massage to all the patients in the intervention group at the ten minutes before the arteriovenous fistula needles have been inserted without starting dialysis session. Totally three sessions were carried out as three times a week in accordance with protocol of hand massage application. Each session lasted for 5 minutes. At the end of the application, The AVF needle was inserted to connect the patients with hemodialysis. VAS score was applied to the patients.

Since the patients in the control group underwent haemodialysis in the morning session, there was no patient from the placebo group in the environment.

The patients in the control group were not subjected to any procedure except for routine clinical practices (such as medication, care, and follow-up, etc.). Patient information

form and VAS forms were applied face-to-face by the researchers at the beginning. After the AVF needle was inserted into patients during the three sessions, the pain they experienced during the procedure was evaluated by the VAS score.

### Protocol of Hand Massage Application

One of the researchers completed the hand massage training in the two and one-half day wellness event. The training included education, observation and demonstration of massage technique and sequencing. This researcher completed all of the hand massages. Liquid vaseline has been used to keep hand slippery before massage and to easily apply massage techniques. The hand massage was completed in alignment with the techniques outlined for nurses that included (a) hypertensive technique, (b) jiggle technique, (c) petrissage technique, (d) rubbing technique, and (e) squeezing technique (Brand, L. R., Munroe, D. J., & Gavin, J. (2013). The effect of hand massage on preoperative anxiety in ambulatory surgery patients. AORN, 97(6), 708-717). An overview of the hand massage began with the staff member extending the hand of their choice to the hand massage provider. The provider started the procedure with rubbing the back of the hand followed by use of the jiggle technique. Next the provider used a circular motion on the palmer surface of the hand following in sequence with the hypertensive technique, petrissage technique, squeezing technique and jiggle technique. Each hand received a massage for 5 minutes. At the completion of the second hand, both hands were gently grasped for one final gentle rub over both sides of each hand.

### Data Analysis

The data of the study were analysed by using SPSS 22.0 packaged software on the computer. Normal distribution of the data was tested by Shapiro-Wilk and Kolmogorov-

Smirnov tests and parametrical tests were used because the data were normally distributed. Summary statistics were given as number of units (*n*), percentage (%), and mean  $\pm$  standard deviation.

Socio-demographic characteristics of the participants were examined by using Chi-square analysis and independent samples t-test. Student t test and one-way Anova were used for VAS pain scores of the patients in the intervention and control groups according to individual follow-up. In all the analyses, the value of  $p < 0.05$  was considered as statistically significant.

### Ethics

Approval was taken from Clinical Trials Ethics Committee of University (2022-251) in order to conduct the study. Written institutional permissions were obtained from the related dialysis centres. The patients were informed about the aim of the study and their verbal and written informed consents were obtained.

### Results

The individuals in the intervention and placebo groups were similar in terms of gender, educational status, marital status, occupation, and residence place ( $p > 0.05$ ). It was found that 52.0 % of patients in the intervention group were male, the mean age of the participants was  $52.86 \pm 19.03$ , 40.0% were graduated from primary school, 72.0 % were married, 56.0% had moderate level of income according to their own statements, and 80.0% were living in urban area. 56.0 % of the patients in the controlgroup were male, the mean age of the participants was  $53.12 \pm 14.07$ , 52.0% were graduated from primary school, 68.0% were married, 60.0% had moderate level of income according to their own statements, and 92.0% were living in urban area (Table 1).

Descriptive Characteristics	Groups			
	Intervention (n= 25)		Control (n=25)	
	n	%	n	%
<b>Gender</b>				
Female	12	48.0	11	44.0
Male	13	52.0	14	56.0
	$\chi^2=5.202$		$p=0.93$	
<b>The Mean Age of the Groups</b>	<b>(x <math>\pm</math>SD)</b>		<b>(x <math>\pm</math>SD)</b>	
	52.86 $\pm$ 19.03		53.12 $\pm$ 14.07	
	$\chi^2=3.812$		$p=0.597$	
<b>Educational level</b>				
Illiterate	5	20.0	2	8.0
Primary school	10	40.0	13	52.0
High school	8	32.0	9	36.0
University	2	8.0	1	4.0
	$\chi^2=4.328$		$p=0.416$	
<b>Marital Status</b>				

Single	7	28.0	8	32.0
Married	18	72.0	17	68.0
	x <sup>2</sup> =0.716		p=0.534	
Income Status				
Low	9	36.0	8	32.0
Middle	14	56.0	15	60.0
High	2	8.0	2	8.0
	x <sup>2</sup> =7.154		p=0.058	
Residence place				
Urban region	20	80.0	23	92.0
Rural region	5	20.0	2	8.0
	x <sup>2</sup> =0.723		p=0.554	
Total	25	100	25	100
X:Mean, SD: Standard Deviation, x <sup>2</sup> :Chi –Squaretest				

**Table 1:** Distribution of Descriptive Characteristics of the Patients in the Intervention and Control Groups.

It was found that while the most common cause of chronic renal failure was glomerulonephritis 32.0% in the intervention group, while this rate was 40.0% in the control group. The mean duration of treatment with dialysis of the

patients in the intervention group was  $44.12 \pm 3.6$  months, and the placebo group were undergoing HD for  $48.15 \pm 3.7$  months. The medical characteristics were similar between two study groups ( $p>0.05$ ) (Table 2).

Medical Characteristics	Groups			
	Intervention (n= 25)		Control (n=25)	
	n	%	n	%
Cause of chronic renal failure				
Glomerulonephritis	8	32.0	10	40.0
Diabetic nephropathy	5	20.0	4	16.0
Cystic kidney disease	3	12.0	3	12.0
Hypertensive nephrosclerosis	4	16.0	4	16.0
Renalartery stenosis	2	8.0	3	12.0
Malignancy	3	12.0	1	4.0
x²=11.604            p=0.072				
The mean of Duration of haemodialysis		(x ±SD)	(x ±SD)	
44.12 ± 3.648.15 ± 3.7				
Total	25	100	25	100
x²=10.124            p=0.48				
X: Mean, SD: Standard Deviation. x²: Chi –Square test				

**Table 2:** Distribution of Medical Characteristics of the Patients in the Intervention and Control Groups.

It was found that the pain mean scores in the first follow-up were lower in the intervention group compared to the control group but the difference between them was not statistically significant ( $p>0.05$ ). While there was no difference in VAS pain points averages before application in the intervention group, a significant decrease in the average of pain points after hand massage was detected. The use of

hand massage significantly reduced the scores of AVF puncture-related pain, which was  $6.18 \pm 1.92$  in the first session, to  $2.96 \pm 1.12$  in the second session ( $p=0.013$ ). However, mean scores of AVF puncture pain had no significant difference in the first and second follow-ups of haemodialysis in the patients of the control group ( $p=0.842$ ) (Table 3).



VAS Pain		Test		
Groups	First Follow-up ( $\bar{x} \pm SD$ )	Second Follow-up ( $\bar{x} \pm SD$ )	t	p
<b>Intervention (n= 25)</b>	6.18 $\pm$ 1.92	2.96 $\pm$ 1.12	56.14	<b>0.013</b>
<b>Control (n=25)</b>	6.42 $\pm$ 1.84	6.12 $\pm$ 2.27	3.246	0.842
<b>Test</b>				
<b>t</b>	2.132	59.15		
<b>p</b>	0.529	<b>0.000</b>		
<i>X: Mean, SD:Standard Deviation, VAS: Visual Analogue Scale, t=Independent Samples t-Test</i>				

**Table 3:** The Distribution of VAS Pain Mean Scores of the Patients in the Intervention and Control Groups.

## Discussion

AVF is created as a result of a surgical procedure that connects an artery and a vein under the skin [16]. For patients to receive hemodialysis treatment, a needle must be inserted into the AVF. Considering that patients receive dialysis treatment at least three times a week, patients receive needle interventions quite frequently [17]. Due to the fistular needle intervention, which is compulsory for conducting hemodialysis treatment, patients experience stress and anxiety. Patients often complain about the pain caused by the needle intervention [18]. It is important to address the pain and concerns of patients with simple interventions and safe methods.

Nurses are the primary healthcare service providers for patients receiving hemodialysis treatment. Therefore, nurses usually place fistula needles on the patients' AVF. They also plan and implement the correct interventions for pain that emerges due to cannulation and assessing the effectiveness of the implemented method. Hand massage is one of these methods. In this present study, hand massage was found to reduce pain scores. There were no studies in the literature hand massage was applied to hemodialysis patients. In the literature, the hand massage applied in conjunction with the aromatherapy rather than the hand massage application alone is based on the AV fistula pain and is generally stated that the application is effective. Kilic Akca et al. (2021) applied massage to the experiment group with lavender oil for a total of 12 sessions, which occurred three times a week and for 4 weeks. The second group received olive oil massage for the same duration. The third group received only standard care practices. Among the group receiving lavender oil, the pain score was 5.23 before the intervention. It was reduced to 2.43 after the intervention. The mean Visual Analog Scale (VAS) scores for the aromatherapy and olive oil massage groups for acute pain after intervention were found to be significantly lower than that of the control group ( $p < 0.001$ ) [19].

Lakhan et al. [37] reported that aromatherapy was more effective in reducing pain in comparison to control and placebo groups. In all studies included in our study, it was determined that aromatherapy reduced the pain levels of fistula needle interventions in hemodialysis patients. By triggering mechanisms in the brain by stimulating the olfactory system with essential oils, aromatherapy blocks the pain nerve messages of the sodium flow in nerve fibers

transmitting pain by blocking the sodium channels [38]. It also stimulates the receptors in the olfactory bulb, transmits the message to the limbic system and causes secretion of endorphin, enkephalin and serotonin. With the secretion of these hormones, there is relaxation in the individual, which causes pain and stress to decrease.

Lakhan et al. [2016] reported that aromatherapy massage was more effective in reducing pain in comparison to control and placebo groups [20]. In all studies, it was determined that aromatherapy reduced the pain levels of fistula needle interventions in hemodialysis patients [21, 22]. By triggering mechanisms in the brain by stimulating the olfactory system with essential oils, aromatherapy blocks the pain nerve messages of the sodium flow in nerve fibers transmitting pain by blocking the sodium channels [23]. It also stimulates the receptors in the olfactory bulb, transmits the message to the limbic system and causes secretion of endorphin, enkephalin and serotonin. With the secretion of these hormones, there is relaxation in the individual, which causes pain and stress to decrease [24].

In the literature, the mechanism for the painkillers of massage is based on Melzack's door control theory and endorphin theory. According to these theories, the mechanoreceptors and touch-sensitive fibers found on the skin and stimulated by massage stimulate substantia gelatinosa cells (door closes), causing the warning passage to T cells to be initiated and thus preventing the pain. When the Substantia gelatinosa cells are stimulated, the endogenous opioid is the release of endorphins and prevents the release of the P-substance that plays a role in endorphin pain transmission, preventing the transfer of pain warnings. These research findings show that hand massage is effective in resolving the pain associated with AV fistula needle penetration [25, 26]. With hand massage, patients can be explained with reduced pain, Melzack's door control theory and endorphins theory.

## Conclusion

In conclusion, the results of the present study showed that hand massage was effective in relieving pain of AVF puncture in patients undergoing haemodialysis. Therefore, hand massage could be effective in managing acute pain. It is recommended that hand massage, which is a non-pharmacological, easy-to-implement, cheap and effective method to reduce the pain associated with AV fistula needle,

be routinely performed as a nursing attempt by hemodialysis nurses.

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### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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